REMARKS

Section 112 rejection

Applicant amends claim 2 to provide antecedent basis for claim 7. This amendment made it necessary to also amend claims 3-6 to avoid grammatical inconsistencies.

Drawing objections

In response to the objection under 37 CFR 1.84(*p*)(5) to FIG. 1, Applicant submits an amended FIG. 1 in which the illuminated edge of the target has been labeled **22** and the reference face of the interferometer has been labeled **18**.

Applicant thanks the Examiner for identifying the redundant use of reference number **36**. In the enclosed substitute FIG. 3, the first interior face is now identified as "**35**". Corresponding portions of the specification are also amended.

In response to the objection under 37 CFR 1.84(*p*)(5), Applicant further amends FIG. 3 to include reference numerals **38** to identify the second interior face and **48** to identify the input beam.

In response to the objection under 37 CFR 1.84(*p*)(5) to FIG. 5, Applicant submits an amended FIG. 5 with a reference numeral **44a** identifying one of the output couplers shown in FIG. 3. Since FIG. 5 does not show an intermediate beam, it would be inappropriate to include the reference numeral **50**. Applicant amends the specification to clarify that it is FIGS. 6 and 7 that show the interferometer in use and that therefore show the measurement beam **50a**. Applicant further clarifies the specification by pointing out that FIGS. 6 and 7 depict just one measurement beam **50a** from the stack of measurement beams **50a-d** exiting the multiplexing portion **34** (see FIG. 3).

In response to the objection under 37 CFR 1.84(*p*)(5) to FIG. 7, Applicant submits an amended FIG. 7 that includes reference numerals **44a** to identify an output coupler and **50a** to identify an intermediate beam emerging from the monolith **12** at the multiplexing portion **34** and re-entering the monolith at the beam-splitting portion **36**.

The coordinate system shown in FIG. 5 also applies to FIGS. 6 and 7. Accordingly, Applicant submits amended FIGS. 6 and 7 containing this change.

Objection to specification

Applicant thanks the Examiner for drawing attention to the potential difficulty in understanding the description of the wavy and straight lines in FIGS. 6-9. The Examiner is correct in inferring that the wavy and straight lines are meant to convey different polarization states. Applicant amends the specification to clarify this point.

FIG. 6 shows the different polarization states of the reference component of the intermediate beam **50a** as it makes its way through the monolith. FIG. 7 shows the different polarization states of the measurement component of the intermediate beam **50a** as it makes its way through the monolith along a different path. Both figures thus show the same "beam" but different "components" of that beam. Mechanically, it is as if one were to unravel the fibers along a middle portion of a rope and cause those fibers to traverse different paths before they rejoined each other at the end of the rope.

Section 102 rejection based on *Sommargren*

The Examiner rejects claims 1 and 14 as being anticipated by *Sommargren*.

Referring to *Sommargren*'s FIG. 1, and with reference to claim 1, the Examiner appears to consider the shear plate **16** to correspond to the claimed "multiplexer portion" and the polarizing beam splitter **40** to correspond to the claimed "beam splitting layer." With reference to claim 14, the Examiner appears to consider the he shear plate **16** to be the claimed "optically transparent monolith". The upper portion of the shear plate **16** would then the claimed "multiplexing layer" and the lower portion of the shear plate **16** would then be the claimed "beam-splitting layer."

For both claims 1 and 14, the "input beam" would then correspond to the circularly polarized beam labeled **12**. The "intermediate beam" would be either one of the two linearly polarized beams labeled **30** and **31** in the figure.

Applicant notes that the intermediate beams of *Sommargren* do not have a reference component and a measurement component. Instead, the *Sommargren* device begins with a circularly polarized input beam **12** having both a reference component and a measurement component. The shear plate **16** splits this input beam into two "intermediate beams" **30, 31**. One of these beams has the measurement component but no reference component; the other has the reference component but no measurement component.

This is quite different from Applicant's claimed invention. Referring to Applicant's FIG. 3, each intermediate beam **50a-d** has the same polarization as the input beam (i.e. the beam entering feed structure **46**). As a result, the intermediate beams all carry *both* a measurement component and a reference component.

This limitation is implicit in the last paragraph of claim 1, which recites

> *said beam splitter portion being configured to separate said intermediate beam into a measurement component and a reference component.*

Applicant amends claims 1 and 14 to make more explicit what was originally implicit in that claim. These amendments more clearly highlight a distinction between the claimed subject matter and the cited reference. Accordingly, Applicant requests reconsideration and withdrawal of the section 102 rejection.

Section 103 rejection of Claim 20

In rejection claim 20, the Examiner suggests that the claimed subject matter could be arrived at by combining the multiplexer and beam-splitter allegedly taught by *Sommargren* into a single integrated structure.

In response, Applicant notes that even if these structures were combined, the result would not result in an intermediate beam having both a measurement component and a reference component.

Applicant amends claim 20 in the manner of claims 1 and 14 to make more explicit what was already implicit in that claim, namely that the intermediate beam must carry with it both a reference component and a measurement component.

This is neither taught nor suggested by *Sommargren*. Accordingly, Applicant requests reconsideration and withdrawal of the section 103 rejection of claim 20.

Summary

Now pending in this application are claims 1-20, of which claims 1, 14, and 20 are independent. No additional fees are believed to be due in connection with the filing of this response. However, to the extent fees are due, or if a refund is forthcoming, please adjust our deposit account no. 06-1050.

Respectfully submitted,

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Version with markings to show changes made

In the claims:

Claims 1-7, 10, 14, and 20 are amended as follows:

1. (Amended) A multi-axis interferometer comprising an optically transmissive monolith having a multiplexer portion and a beam splitter portion,

said multiplexer portion being configured to split an input beam into a corresponding plurality of intermediate beams, each [~~of said intermediate beams~~] of which has a measurement component having a first polarization and a reference component having a second polarization, each of said intermediate beams being directed toward said beam splitter portion through a corresponding output port of said multiplexer portion;

said beam splitter portion being configured to direct [~~separate said intermediate beam into a~~] said measurement component along a measurement path and to direct said [~~a~~] reference component along a reference path.

2. (Amended) The interferometer of claim **1**, wherein said multiplexer portion comprises:

a first interior face, and

a second interior face opposite to said first interior face, said second interior face having disposed thereon [~~an~~]a plurality of partially-transmissive output ports.

3. (Amended) The interferometer of claim **2**, wherein said output ports comprise[~~s a~~] beam steering elements.

4. (Amended) The interferometer of claim **3,** wherein said beam steering elements [~~is~~]are

configured to refract a beam incident from said first interior face into an intermediate beam normal to said second interior face.

5. (Amended) The interferometer of claim **3**, wherein each of said beam steering elements comprises a diffraction grating.

6. (Amended) The interferometer of claim **3**, wherein each of said beam steering elements comprises a volume of material having an index of refraction selected to refract said beam incident from said first interior face into said intermediate beam normal to said second interior face.

7. (Amended) The interferometer of claim **2**, wherein said plurality of partially-transmissive refractors have transmissivities selected such that said each of said intermediate beams carries substantially the same power as any other intermediate beam.

10. (Amended) he interferometer of claim **1**, further comprising a corner reflector in optical communication with said output port and said beam splitter portion, said corner reflector being configured to direct said intermediate beam from said multiplexer portion into said beam splitter portion.

14. **(Amended)** multi-axis interferometer comprising:

an optically transparent monolith having

a multiplexing layer that divides an input beam into a plurality of intermediate beams, each of which has a measurement component having a first polarization and a reference component having a second polarization, and

a beam splitting layer that directs said [~~a~~] measurement component of each of said intermediate beams along a measurement path[~~,~~] and said [~~a~~] reference component of each of said intermediate

beams along a reference path;

an output coupler in optical communication with said multiplexing layer and said beam splitting layer.

20. **(Amended)** A multi-axis interferometer comprising:

a beam multiplexer for forming, from an input beam, a plurality of intermediate beams, each of which has a measurement component having a first polarization and a reference component having a second polarization, each of said intermediate beams [~~from an input beam~~];

a beam splitter integral with said beam multiplexer for directing said [~~a~~] measurement component [~~of said intermediate beam~~] along a measurement path having a first path length and directing said reference component along a reference path having a second path length;

an output coupler providing optical communication between said beam multiplexer and said beam splitter.

In the specification:
On page 5, the paragraph beginning on line 24 is amended as follows:

The monolith **12** itself is divided into a multiplexing layer **34** and a beam-splitting layer **36**. As indicated by the dashed line in FIG. 1, these two layers are not joined or affixed to each other. The multiplexing layer **34** and the beam-splitting layer **36** are part of the same monolithic structure in much the same way that the individual transistors of an integrated circuit are part of, or integral with, the same silicon crystal. The multiplexing layer **34** extends from the rear face **14** to the beginning of the beam-splitting layer **36** in the interior of the monolith **12**. This multiplexing layer **34** has opposed first and second mirrored interior faces [~~**36**~~]**35**, **38**, best seen in FIG. 3, that are perpendicular to the rear face **14** of the monolith **12**.

On page 6, the paragraph beginning on line 1 is amended as follows:

FIG. 3 shows a cross-section obtained by slicing the multiplexing layer **34** along the *xy* plane. The first interior face [~~36~~]35 has a first facet **40** that is coplanar with the reference face and a second facet **42** that makes an obtuse angle with the first facet **40**. The second interior face **38** is punctuated by a plurality of output couplers **44a-d** (designated generally as **44**) arranged along a line extending parallel to the rows in the array of retro-reflectors **28**. The number of output couplers **44** on the second interior face **38** corresponds to the number of such rows.

On page 7, the paragraph beginning on line 25 is amended as follows:

The beam-splitting layer **36**, shown in the cross section of FIG. 5, is bounded by the I/O face **20**, the reference face **18**, the measurement face **16**, and by the multiplexing layer **34**. A corner reflector **58** is mounted on the I/O face **20** and oriented to direct intermediate beams **50** (shown in FIGS. 6 and 7) emerging from the output couplers **44** into the beam-splitting layer **36**. FIGS. 5 and 6 show[~~s~~] an intermediate beam[~~s~~] **50a** exiting the output coupler **44** in the -x direction and being reflected in the *z* direction by a rear facet **60** of the corner reflector **58**. A front facet **62** opposite the rear facet intercepts intermediate beams **50** traveling in the *z* direction and reflects them in the +*x* direction, into the beam-splitting layer **36** of the monolith **12**.

On page 8, the paragraph beginning on line 20 is amended as follows:

The input beam **48** of the interferometer **10** includes two orthogonally polarized components: a reference component and a measurement component. As these components traverse the monolith **12**, they lose and then recover their original polarization states.

For example, upon[~~Upon~~] entering the beam-splitting layer **36**, the reference component has a first linear polarization (the "P" polarization). This polarization is identified by the straight line within the corner reflector **58**. As it traverses the monolith **12**, the reference component becomes orthogonally polarized ("S" polarized). This portion of the reference component is identified by the wavy line in FIG. 6. Before it finally exits the monolith **12**, the reference component recovers its original polarization, which is shown by the straight line exiting the monlith **12.**

Similarly, [~~and~~] the measurement component enters the beam-splitting layer **36** with[~~has~~] a second linear polarization (the "S" polarization) orthogonal to the P polarization. This polarization is identified by the wavy line in the corner reflector **58** of FIG. 7. As it traverses the monolith **12**, the measurement component becomes "P" polarized. This portion of the reference component is identified by the straight line in FIG. 7. Before it finally exits the

monolith **12**, the measurement component recovers its original polarization, which is shown by the wavy line exiting the monlith **12.**

On page 8, the paragraph beginning on line 25 is amended as follows:

FIGS. 6 and 7 show the paths followed by the reference [~~beam~~] component and the measurement [~~beam~~]component of the intermediate beam **50a** lying in the plane that intersects the bottom row of retro-reflectors. The polarization states of these components shift at certain points along their respective paths through the beam-splitting layer. The shifting polarization states of these compoeenents are identified by the straight and wavy lines used to designate certain portions of their paths. [~~The measuremen beam in these and subsequent figures is shown as a first wavy line; the reference component, which is orthogonally polarized relative to the measurement component, is shown by a second wavy line rotated ninety degrees relative to the first wavy line (and hence appearing to be a straight line).~~] The reference and measurement components sometimes traverse the same portion of their respective paths twice, in different polarization states. For clarity, these portions of the paths are shown as being slightly displaced from each other. However, [~~Although these paths are shown as being displaced from each other,~~] this displacement is shown only to facilitate understanding the operation of the beam-splitting layer **36**. In fact, the component is retracing [~~measurement and reference components of the beam travel along~~] the same physical path, but with different polarization states.

In the drawings:

FIGS. 1, 3, and 5-7 have been amended. Substitute sheets with amendments shown in red are attached.